Overview of Diazinon
Revised Risk Assessment

12/05/00

Introduction

This document summarizes EPA's human health and ecological risk findings and conclusions for the organophosphate pesticide diazinon, as presented fully in the revised documents, "Diazinon: HED Chapter for the Reregistration Eligibility Decision Document," dated December 2000 and "EFED RED Chapter for Diazinon" dated November 16, 2000. The purpose of this summary is to assist the reader by identifying the key features and findings of these risk assessments, and to better understand the conclusions reached in the assessments. This summary was developed in response to comments and requests from the public which indicated that the risk assessments were difficult to understand, that they were too lengthy, and that it was not easy to compare the assessments for different chemicals due to the use of different formats.

These risk assessments for diazinon will soon be followed by an opportunity for public comment on risk management. The Agency will make the refined risk assessment available to the public by placing it in the Pesticide Docket and posting it on the Internet. Public comments will be invited and welcomed for 60 days. After considering the comments received, EPA will begin the risk management public participation process period for diazinon.

It has been determined that the organophosphates share a common mechanism of toxicity; the inhibition of cholinesterase levels. As required by FQPA, a cumulative assessment will need to be conducted to evaluate the risk from food, water and non-occupational exposure resulting from all uses of OPs. Currently, the Agency is developing the draft methodology needed to conduct such an assessment with guidance/advise provided by the Scientific Advisory Panel. This draft methodology will be available for public comment when it is completed. Consequently, the risks summarized in this document are only for diazinon.

Use Profile

- **Insecticide/Acaricide/Nematicide:** Registered for use as a nonsystemic insecticide-acaricide-nematicide for the control of soil insects and pests of fruit, vegetables, tobacco, forage and field crops. Registered non-food uses include: range, pasture, grasslands, ornamentals, food/feed handling establishments, livestock areas, and indoor/outdoor residential sites. Diazinon has veterinary uses for fleas and ticks. Diazinon is also used for control of household insects, grubs, nematodes in turf, seed treatments and fly control.

- Most agricultural uses are classified as **restricted-use** based on avian toxicity.

- **Formulations**: Formulations include dust, granules, wettable powders, seed dressings, emulsifiable solutions, impregnated materials, encapsulated materials, soluble concentrates, flowable concentrates and ready-to-use solutions.

- **Methods of Application**: Diazinon can be applied as a foliar or soil treatment via aerial application, airblast, groundboom, tractor and push-type granular spreaders and hand-held spray equipment. It also has homeowner uses including lawn treatments and spot treatments which can be applied by aerosol cans, spray equipment and granular spreaders.

- **Use Rates**: Use rates vary from 0.25 lbs ai/acre or 0.01 lbs ai/gallon to 4.35 lbs ai/acre.

- **Annual Poundage:** Based on available usage information, for 1987 through 1997, total annual domestic usage of diazinon is over 13 million pounds active ingredient. Most of this is allocated to outdoor residential uses (39%), lawn care operators (19%), and pest control operators (11%). States with significant agricultural usage include California, Texas, and Florida.

- **Registrant**: Syngenta (formerly known as Novartis Crop Protection, Inc.) and Makhteshim-Agan of North America Inc.

Human Health Risk Assessment

Revisions to the Preliminary Risk Assessment include:

Under the residue chemistry sections of the risk assessment, revisions have been made in response to the 30-day error correction review, response to comments, and new data .

- The Agency notes that the following raw agricultural commodities were excluded from the current dietary risk assessment: olives, peanuts, pecans, soybeans, sugarcane, green beans, and cowpeas. The registrant voluntarily canceled these uses on December 27, 1996. The Agency is proposing to revoke these tolerances.

- The acute and chronic dietary analyses were revised to include residues in beef fat because 6 new cattle ear tag studies indicate residues in beef fat are present. Because secondary residues from milk, eggs, poultry, meat and meat byproducts, except for those of beef and sheep, are not expected, these commodities have been excluded from the dietary analysis.

- Secondary residues of diazinon from sheep commodities based on the sheep spray use were included.

- The registrant (Makhteshim-Agan) has expressed interest in supporting the use on kiwi fruit and should be providing the necessary residue data. IR-4 has expressed interest in supporting uses on figs, watercress, and filberts, and providing the necessary residue data.

These four commodities were included in the dietary risk assessment.

- Also included in the dietary assessments were: bananas, citrus, coffee, cottonseed meal and oil, dandelion, and sorghum (bananas and citrus will be retained for import tolerances).

Under the occupational/residential sections of the risk assessment, revisions have been made in response to comments and new data.

- Use sites were updated (i.e., termite use deleted) and the occupational/residential exposure and risk estimates have been revised to incorporate new data including biomonitoring exposure data and a 21 day dermal toxicity study. Specifically, this includes new postapplication occupational assessments for greenhouse uses, and new postapplication residential assessments for turf and indoor crack and crevice uses.

- Postapplication residential exposures and risk estimates have been calculated using the Revised Standard Operating Procedures for Residential Exposure Assessments Guide, 2000.

- The dermal endpoint has changed. The previous endpoint used an oral NOAEL of 0.25 mg/kg/day (short-term) and 0.02 mg/kg/day (intermediate-term) with 100% dermal absorption. Using a 21 day dermal toxicity study based on plasma and brain ChEI, the new dermal NOAEL is 1 mg/kg/day with a target MOE= 100 for short term exposure and 300 for intermediate and long term exposure.

Acute Dietary (Food) Risk

Acute dietary risk is calculated taking into account quantity of food eaten in one day and maximum, or high-end residue values in the food. A risk estimate that is less than 100% of the acute Population Adjusted Dose (aPAD) (the dose at which an individual could be exposed on any given day and no adverse health effects would be expected) does not exceed the Agency's level of concern.

The acute dietary risk (food) of diazinon is below the Agency's level of concern (i.e., less than 100% aPAD is utilized) for the general U.S. population and all population subgroups, including infants and children at the 99.9th percentile of exposure. The most highly exposed subgroup were children 1-6 years old at 63 % of the aPAD. This assessment includes all currently registered uses.

Table 1. Diazinon: Acute Dietary Risk % aPAD at 99.9th Percentile

Population Subgroup	% aPAD Consumed
General U.S.	37

Children (1 to 6 yrs)	63

- The acute dietary risk endpoint is based on the inhibition of plasma cholinesterase activity in rats at a LOAEL of 2.5 mg/kg/day resulting from two single dose studies in male and female Sprague-Dawley rats. The NOAEL is 0.25 mg/kg/day.

Table 2. Diazinon: Acute Toxicity Endpoint

Acute Toxicity Endpoint			
EXPOSURE SCENARIO	**DOSE**	**ENDPOINT**	**STUDY**
Acute Dietary	NOAEL=0.25 mg/kg	Plasma cholinesterase inhibition	Acute Neurotoxicity - Rat Study.
	UF =100x FQPA = 1x	**Acute PAD = 0.0025 mg/kg/day**	

- Uncertainty Factor (UF) is 100. 10x for interspecies extrapolation and 10x intraspecies variability.

- The 1996 Food Quality Protection Act (FQPA) requires the Agency to apply an additional safety factor of 10 during its risk assessment as a special protection for infants and children. The 10x safety factor was reduced to 1x based on the: 1) completeness of the toxicology database; 2) lack of evidence of increased susceptibility following pre-, and post-natal exposures; and 3) the use of adequate data (actual, surrogate and/or modeling outputs) which do not underestimate dietary and non-dietary exposures.

- The acute RfD is calculated to be 0.0025 mg/kg/day. Because the FQPA safety factor was reduced to 1x, the acute and chronic RfDs are equal to the acute and chronic PADs, respectively. The acute Population Adjusted Dose (aPAD) is 0.0025 mg/kg/day.

- The Dietary Evaluation Exposure Model (DEEM) was used to estimate acute dietary exposure in a probabilistic mode.

- The acute dietary risk analysis evaluates individual food consumption as reported by respondents in the USDA 1989-1992 Continuing Survey of Food Intake by Individuals (CSFII) and accumulates exposure to the chemical for each commodity. This analysis is refined in that it uses monitoring data from USDA's Pesticide Data Program (PDP) and FDA Surveillance Monitoring Program to calculate anticipated residues for use in the acute dietary analysis. Data on the percentage of a crop-treated were incorporated for all commodities with diazinon tolerances included in the acute dietary assessment. See Appendix A for details on what was used in the analysis for specific commodities.

- Sheep fat and meat and beef fat have been identified as the food commodities contributing the most to the acute dietary risk estimates.

Further Refinement

- Additional information on the percentage of domestic and imported sheep and beef cattle treated with diazinon will allow refinement of the risk estimates. The Agency assumed that 3% of domestic sheep and 100% of imported sheep are treated with diazinon. If sheep and beef commodities are removed from the acute dietary analysis, risk estimates for all subgroups would drop below 47% of the aPAD. Additional information on the percentage of imported sheep treated with diazinon may also help refine the risk assessment.

Chronic Dietary (Food) Risk

Chronic dietary risk is calculated by using the average consumption value for food and average residue values on those foods. A risk estimate that is less than 100% of the chronic Population Adjusted Dose or cPAD (the dose at which an individual could be exposed over the course of a lifetime and no adverse health effects would be expected) does not exceed the Agency's risk concern.

The chronic dietary risk for diazinon does not exceed the Agency's level of concern (i.e., less than 100% of the cPAD is utilized) for all subpopulations. The most highly exposed subgroup is Children 1-6 years old at 22% of the cPAD.

Table 3. Diazinon: Chronic Dietary Risk % cPAD at 99.9 Percentile

Population Subgroup	% cPAD Consumed
General U.S.	14
Children (1 to 6 yrs)	22

- The NOAEL used to calculate the chronic dietary risk estimate was determined using a weight-of-the-evidence approach based upon the results of seven studies (in dogs from 4-week, 90-day, and 1-year feeding studies, and in rats from a 28-day feeding study, a 90-day feeding study, a 90-day neurotoxicity study, and a 2-year feeding study). The NOAEL was determined to be 0.02 mg/kg/day based on the principal effect plasma cholinesterase inhibition. There were no other effects observed at this dose (e.g., no red blood cell or brain cholinesterase inhibition nor clinical signs of toxicity or systemic effects).

Table 4. Diazinon: Chronic Toxicity Endpoint

Chronic Toxicity Endpoint			
Chronic Dietary	0.02 mg/kg/day	Plasma cholinesterase inhibition.	4-week, 90-day and 1-year studies in dog 4-week, 90-day feeding, 90-day neurotoxicity and 2 -year studies in rat
	UF= 100x FQPA = 1x	Chronic PAD = 0.0002 mg/kg/day	

- Uncertainty Factor is 100. 10X for interspecies extrapolation and 10X for intraspecies variability. As with the aPAD, the FQPA factor was reduced to 1.

- The chronic Population Adjusted Dose (cPAD) is calculated to be 0.0002 mg/kg/day.

- The Dietary Exposure Estimate Model (DEEM™) was used to calculate the chronic dietary exposure estimates based on average consumption for the U.S. population and population subgroups including infants and children.

Further Refinement

- Additional information on the percentage of domestic and imported sheep, beef cattle and imported crops treated with diazinon will allow refinement of the chronic risk estimates. If sheep and beef commodities are removed from the chronic dietary analysis, risk estimates for all subgroups are below 13% of the cPAD.

Drinking Water Dietary Risk

Drinking water exposure to pesticides can occur through groundwater and surface water contamination. EPA considers both acute (one day) and chronic (multiple year) drinking water risks and uses either modeling or actual monitoring data, if available, to estimate those risks. Modeling is carried out in tiers of increasing refinement, but is designed to provide high-end estimates of exposure. To determine the maximum allowable contribution from water allowed in the diet, EPA first looks at how much of the overall risk is contributed by food and then determines a "drinking water level of comparison" (DWLOC) to ascertain whether modeled or monitoring levels exceed this level. The Agency uses DWLOC as a surrogate to capture risk associated with exposure from pesticides in drinking water. Modeling estimates represent an upper bound on concentrations.

- Environmental fate data indicate that diazinon and its degradates may occur in both ground water and surface waters to varying degrees. Therefore, consideration is being given to the probability of residues and toxicologically significant metabolites of diazinon appearing in ground water.
- Diazinon is only moderately mobile and persistent. Laboratory data indicate that diazinon will not persist in acidic water; however, in neutral and alkaline waters, residues may be

quite persistent.

- Oxypyrimidine is the main soil and water degradate. Two hydroxy pyrimidine compounds (both lacking the organophosphate moiety) have been recovered from soil, groundwater, and surface water.

- Modeling and monitoring data for drinking water do not consider diazinon degradates. There is evidence that degradates may be formed by water treatment such as chlorination. There is additional uncertainty regarding the toxicity of these degradates.

- EPA 's Office of Water has established an Adult Lifetime Health Advisory (HAL) for diazinon at 0.6 ppb, but has not established a Maximum Contaminant Level (MCL).

- Risk estimates for ground water are based on SCI-GROW modeling, which is an unrefined assessment that provides a high-end estimate. SCI- GROW is a tier 1 model that does not provide different values for acute and chronic estimated residue levels in water, therefore the same value is reported for both acute and chronic.

Acute Exposures

- For acute exposure to diazinon in **surface water** based on ***model estimates*** there is a **potential concern** for infants and children (1 to 6).

- For acute exposure to diazinon in **surface water** based on ***monitoring data*** there is **no concern.**

- For acute exposure to diazinon in **groundwater** there is **no concern**. Concentration estimates based on **modeling** and **monitoring** are less than the acute DWLOC values for all subgroups.

Table 5. Acute DWLOC Values Compared to Monitoring/Modeling Estimates:

ACUTE	**Food Acute (99.9th) % aPAD**	**Acute DWLOC**	**Acute EEC**	
			Surface (model/monitor)	**Ground (model/monitor)**
US Population	37%	56 ppb	70ppb / 3 ppb	0.8ppb / 0.02 ppb
Children 1-6 yrs	63%	9 ppb		

Chronic Exposures

- Chronic exposure to diazinon in surface water and groundwater based on monitoring data is not of concern for all subgroups.

- Chronic exposure to diazinon in surface water and groundwater based on modeling data is of potential concern.

Table 6. Chronic DWLOC Values Compared to Monitoring/Modeling Estimates:

CHRONIC	Food Chronic %PAD	Chronic DWLOC	Chronic EEC	
			Surface (model/monitor)	Ground (model/monitor)
US Population	14%	4	9ppb / 0.5 ppb	0.8ppb / 0.02 ppb
Children 1-6 yrs	22%	0.2		

Further Refinements

- Additional monitoring information on surface water sourced drinking water would help refine the drinking water risk assessment.

Residential Risk

Residents can be exposed to a pesticide through mixing, loading, or applying a pesticide, or by re-entering a treated site after a residential or commercial (pest control operator and lawn care operator) application. Residential risk is measured by a Margin of Exposure (MOE) which determines how close the residential exposure comes to the No Observed Adverse Effect Level (NOAEL) taken from animal studies. Generally, MOEs that are greater than 100 do not exceed the Agency's level of concern. However for the diazinon intermediate and long term dermal endpoints, an additional 3X is applied to account for the extrapolation from a 21 day dermal study to longer term exposures. The target MOE is 300. For inhalation risk assessments (all time periods) a 3X is factored in for the lack of a NOAEL in the critical study and consequently the use of a LOAEL, resulting in a target MOE of 300 as well.

- Diazinon has a wide variety of residential uses including lawn treatments, home gardens, ornamental treatment, indoor crack and crevice and pet collars. Diazinon can be applied by professional pest control operators (PCOs/LCOs) or in most cases by homeowners. Treatments can be applied by many methods including aerosol cans, spray equipment and granular spreaders.

- Based on currently registered uses all residential applicator scenarios pose risks of concern and all post application scenarios pose risk of concern to children.

- Risk to residential applicators using granular products are not of concern if applicators wear long pants.

- Post application exposure (dermal and inhalation only) to children playing on treated lawns is mostly of concern for liquid products and is not of concern for granular products except in one location. Risks are of concern if other incidental ingestion is added (such as

hand to mouth).

- Watering in and waiting for applications to dry as specified on some labels lessens risk concerns.

The registrants are proposing to mitigate **indoor** residential risk concerns by canceling all indoor uses including pet collars.

- Production of these products will end in June 2001 with retail sales ending in December 2002.

The registrants have also proposed stop production in 2003 of all **outdoor** residential products and stop sale in 2004.

- Registrants will buy back all unsold residential products on retailer shelves after 2004.

- 3 out of 4 residential post application scenarios and 3 out of 6 residential applicator scenarios were assessed using chemical-specific studies submitted by the registrant. In the absence of chemical-specific data, the other exposures were estimated using the SOPs for residential exposure assessments. In some cases, chemical-specific studies were supplemented by the SOPs.

- The exposure duration for short-term assessments is 1 to 7 days, intermediate-term duration is 1 week to 6 months and long-term exposures are durations greater than 6 months.

Table 7. Diazinon: Residential Endpoints

	NOAEL	Endpoint	Study
Short-Term (Dermal)	NOAEL= 1 mg/kg/day MOE of 100 required	significant serum and brain cholinesterase inhibition at 5 mg/kg/day	21 day dermal rabbit study
Intermediate-Term (Dermal)	NOAEL= 1 mg/kg/day MOE of 300 required Additional 3x for duration of exposure	significant serum and brain cholinesterase inhibition at 5 mg/kg/day	21 day dermal rabbit study
Long-Term (Dermal)	NOAEL= 1 mg/kg/day MOE of 300 required Additional 3x for duration of exposure	significant serum and brain cholinesterase inhibition at 5 mg/kg/day	21 day dermal rabbit study
Short, Intermediate and Long -Term (Inhalation)	LOAEL= 0.026 mg/kg/day MOE of 300 required Additional 3x for selection of LOAEL	.significant plasma and RBC cholinesterase inhibition at 0.026 mg/kg/day	21 day whole body rat inhalation study (6 hours/day)

Table 8: Outdoor Residential Handler Risk Estimates[1]

Exposure Scenario	Data Source	Amount Handled per Day or Area Treated	Pre-mitigation Risk Estimates			Post-mitigation Risk Estimates		
			MOE		ARI (Target ARI ≥ 1)	MOE		ARI
			Dermal Target MOE ≥100	Inhalation Target MOE ≥300		Dermal	Inhalation	
Mixing/Loading/Applying Liquids								
Low Pressure Handwand	Novartis Study	1000 ft^2 (0.023 acre)	62	130	0.25	Phase-out		
		0.021 lb ai (4 gallons)	Biomonitoring:: 330 Arithmetic mean. (AM) 180 (90th percentile)		NA			
Backpack Sprayer	Residential SOPs/PHED	1000 ft^2 (0.023 acre)	150	660	0.89	Phase-out		
Ready-to-Use Garden Hose End Sprayer	Novartis Study	0.5 acres	22	20	0.051	Phase-out		
		5,000 ft^2 (0.11 acre)	Biomonitoring: 410 Geometric mean (GM) 110 (90th percentile)		NA			
		0.5 acres	Biomonitoring: 94		NA			
	ORETF Diazinon Study	0.5 acres	13	83	0.09			
	Combined Data from Novartis and ORETF Studies		15	57	0.084			
Conventional Hose End Sprayer	Novartis Study	0.5 acres	7	80	0.058	Phase-out		
		5,000 ft^2 (0.11 acre)	Biomonitoring: 260 (GM) 27 (90th percentile)		NA			
		0.5 acres	Biomonitoring: 60		NA			
	ORETF Diazinon Study	0.5 acres	3	57	0.03			
	Combined Data from Novartis and ORETF Studies		4	61	0.034			
Loading/Applying Granules								
	ORETF Study with Dacthal		68		0.59 (G.M)			
Loading/Applying with Push Type Spreader		0.344 acres (15,000 ft^2)	1,300 (G.M)			Phase-out		

Exposure Scenario	Data Source	Amount Handled per Day or Area Treated	Pre-mitigation Risk Estimates			Post-mitigation Risk Estimates		
			MOE		ARI (Target ARI ≥ 1)	MOE		ARI
			Dermal Target MOE ≥100	Inhalation Target MOE ≥300		Dermal	Inhalation	
	ORETF Study with Dacthal (long pants, short sleeved shirt, no gloves)		520 (long pants)		2.4			
Belly Grinder	Residential SOPs/PHED	1,000 ft^2 (0.023 acre)	6.3	290	0.059	Phase-out		

[1] All residential handler use patterns are expected to result in short-term exposures (1-7 days). Dermal unit exposures are based on homeowner applicators wearing short sleeve shirts, short pants and no gloves, except where noted. Application rate = 4 lbs ai/acre for liquids and 4.4 lbs ai/acre for granules. Biomonitoring results are based on both the geometric or arithmetic mean and the 90th percentile. Because exposure estimates are based on a urinary measurement (i.e. there is no way to tell whether it was a dermal or inhalation exposure pathway), only one MOE is presented. There are significant uncertainties in comparing biomonitoring data results with passive dosimetry results due to the use of different toxicological endpoints.

[2] Area treated: EPA generally assumes 1,000 ft ^{2} = spot treatment and 0.5 acres = typical size of lawn . 15,000 ft^2 or 0.344 acres was lawn size assumed for push type granular spreader because some granular labels state that residents should only treat 15,000ft^2, however, some labels do not restrict the area treated and should be modified. For hose end sprayers, results for 5,000 ft^2 or 0.11 acre are also presented because that was the area treated in the registrant study based on the fact that diazinon is packaged in ready-to-use containers that are designed to treat 5,000 ft^2.

Table 9: Outdoor Residential/Recreational Postapplication Risk Estimates[1] (Target ARI ≥ 1)

Exposure Scenario	Pre-mitigation ARIs [2,,3] (dermal and inhalation)		Post-mitigation ARIs (dermal and inhalation)	
	Adult	Child	Adult	Child
Turf Treatment (liquid)	**0.56 -1.0 non-irrigated 1.0-1.24 irrigated**	**0.2-0.4 non-irrigated 0.73-1.0 irrigated**	**Phase-out**	
Turf Treatment (granular)	**2.0-5.0** non-irrigated **not applicable**	**0.59-1.3** non-irrigated **not applicable**	**Phase-out**	

[1] All outdoor residential use patterns are expected to result in short-term exposure (1-7 days). Application rate = 4 lbs ai/acre for liquids and 4.4 lbs ai/acre for granules. Assumes short pants, short sleeved shirt and no gloves.

[2] Turf labels require watering in for granular formulations, but recommend watering prior to or following liquid turf treatment depending on the pest concern.

[3] The range of values represents two different time intervals used to assess average air concentrations; 0-2 hours after application and 2-4 hours after application.

Table 10: Indoor Postapplication Inhalation Risk Estimates[1]

Source of Exposure Calculations	Air Concentration μg/m3	Pre-mitigation MOE[1] (Target≥300)		Post-mitigation MOE (Target≥300)	
		Adult	Child	Adult	Child
Novartis 1980, 1981 and Wright and Leidy 1982	37.8 $\mu g/m^3$ (mean from three studies)	3.2	1.2	Use to be canceled	
EPA's Non-occupational Pesticide Exposure Study, 1993	0.32 (mean)	380	140	Use to be canceled	
	1.9 (95^{th} percentile)	63	26		

[1] During the 24 hours following indoor application.

Table 11: Indoor Postapplication Dermal Risk Estimates [1]

4E-Label	Application Rate (grams)	Area/Type of Surface	MOE (Target≥100)		MOE (Target≥100)	
			Adult	Toddler	Adult	Toddler
Concentration/amt used in registrant's inhalation exposure study MRID 44348801 (1%, 1.3 liters)	**11.8**	**Kitchen/hard surfaces**	**0.068 0.68 (10% contact of surfaces)**	**0.04 0.4 (10% contact of surfaces)**	**Use to be canceled**	
½ conc. used in registrant's inh. exposure study (0.5%, 1.3 liters)	**5.9**	**Kitchen/hard surfaces 40.5**	**0.13 1.3 (10% contact of surfaces)**	**0.084 0.8 (10% contact of surfaces)**	**Use to be canceled**	
Conc./amt. typical for moderate infestations in main living areas (0.5%, 1-gal)	**17.7**	**House/carpet surfaces**	**0.2 0.84 (25% contact of surfaces)**	**0.12 0.48 (25% contact of surfaces)**	**Use to be canceled**	
Conc/amt. typical for minor infestations in main living areas (0.25%, 1-gal)	**8.9**	**House/carpet surfaces**	**0.4 1.6 (25% contact of surfaces)**	**0.24 1 (25% contact of surfaces)**	**Use to be canceled**	

[1] Reflects short-term (1-7 day) exposure. The data to complete the dermal exposure risk assessment were obtained from the following sources: inhalation exposure data in Novartis's study, current registrant's label - 4E's application rate, current real-estate information, information from the Revised SOPs Residential Exposure Assessments Guide.

Table 12: Dermal Risk Estimates from Diazinon Pet Collar Products[1]

Product Registration	Percent Active Ingredient	Grams of Diazinon in Product	Pre-mitigation MOE (Target≥300)		Post-mitigation MOE (Target≥300)	
			Adult	Child	Adult	Child
EPA No. 2517-24	11	5	210	45	Use to be canceled	
EPA No. 2517-25	11	2.2	480	100	Use to be canceled	
EPA No. 2517-29	15	1.8	590	120	Use to be canceled	
EPA No. 2517-30	15	3.5	300	66	Use to be canceled	

[1]Pet collar exposures are considered potentially long-term. In leu of chemical-specific data, the Residential SOP was used (i.e., assumed 1% of the ai was available for dermal exposure). Exposures were amortized over time assuming linear dissipation.

Acute Aggregate Risk

Aggregate risk looks at the combined risk from exposure through food, drinking water, and residential uses of a pesticide. Generally, all risks from these exposures must be less than 100% of the acute and chronic PADs to be considered acceptable or not less than the target MOE or ARI for short and intermediate term exposures.

Aggregate risk assessment for acute exposures to diazinon includes one day exposures through food and drinking water, only. Exposure to diazinon from food sources (based on refined exposure estimates) and drinking water (based on surface water monitoring data, and ground water monitoring data and model estimates) does not exceed EPA's level of concern for acute dietary risk for any subgroup analyzed. However, if surface water *model* estimates are used in the assessment, risk estimates for infants and children potentially exceed the Agency's level of concern.

EPA has concerns for aggregate short-term exposures to diazinon for residential handlers of turf products. These uses are being phased out and have not been aggregated in the revised risk assessment.

Likewise, using data from chemical-specific studies, postapplication dermal, inhalation and oral exposures from indoor crack and crevice treatments result in MOEs less than 100 and 300, respectively. However, registrants have requested voluntary cancellation of these uses

Chronic Aggregate Risk

The chronic aggregate risk assessment for exposure to diazinon includes long-term, average exposures to diazinon through food and drinking water only since there are no residential uses that result in chronic exposure.

For chronic exposure to diazinon in **surface water** based on ***modeling estimates*** there is a **potential concern** for all subgroups. For chronic exposure to diazinon in **surface water** based on ***monitoring data*** there is no potential concern for children 1-6 years old. For chronic exposure to diazinon in **groundwater** based on **modeling estimates** there is potential concern for children 1-6 years old. Chronic aggregate risk estimates based on estimated exposures from food (based on refined exposure estimates) and drinking water do exceed EPA's level of concern for children 1-6 years old.

Occupational Risk

Pesticide handlers and reentry workers can be exposed to a pesticide when mixing, loading, or applying a pesticide and when entering treated sites. Worker risk is measured by a Margin of Exposure (MOE). For diazinon, MOEs less than 100 exceed the Agency's level of concern for short term occupational dermal and inhalation exposure (1-7 days), and for intermediate occupational dermal and inhalation exposure (7 days to several months).

Restricted-entry intervals (REIs) are calculated to determine the minimum length of time required following an application before workers are allowed to reenter a treated area. Entry restrictions are calculated to determine the minimum length of time required following an application before crop workers are allowed to reenter a treated area with, or without the use of personal protective equipment to mitigate risks. REIs and entry restrictions are estimated in hours or days.

EPA has conducted an exposure/risk assessment for occupational exposure scenarios resulting from diazinon's registered uses. A margin of exposure (MOE) greater than 100 for short- term, intermediate-term, and long-term dermal occupational exposures to diazinon does not exceed EPA's level of concern. For occupational inhalation exposures of any duration, a MOE of 300 is necessary. EPA uses the Aggregate Risk Index method (ARI method). When MOEs for multiple exposure pathways differ, but exposures across those pathways must be combined under an aggregate risk assessment. ARIs greater than 1.0, do not exceed the Agency's level of concern.

EPA has concerns regarding occupational exposures and risk estimates for a number of exposure scenarios during application for pesticide handlers. No chemical specific exposure data were available for the exposure assessments for mixer/loader/applicators (handlers). Short-term and intermediate-term dermal and inhalation exposure assessments were made using surrogate data from PHED. These scenarios are listed in table 13.

<u>Risks Based on Short-Term Dermal Exposure:</u>

The combined short-term dermal and inhalation ARIs are shown on Table 13 for all scenarios. The target ARI is ≥ 1, where ARIs ≥ 1 do not exceed HED's level of concern.

As shown on Table 13, with PPE and/or engineering controls only 5 exposure scenarios have ARIs ≥ 1 and therefore, do not exceed HED's level of concern for combined short-term dermal and inhalation exposure. These scenarios are as follows:

- mixing/loading liquids for airblast application at 1 lb ai/A for 20 acres (ARI=1.13-1.9)

- mixing/loading liquids for right-of-way sprayer at 0.5 lb ai/A for 40 acres (ARI=1.13-1.9)
- applying liquids with a groundboom tractor at 0.75 foliar rate for 80 acres with engineering controls (ARI=1.2)
- flagging for spray applications at 0.5 and 1.25 lb ai/A for 350 acres (ARI=1.6-3.9)

Intermediate and Long-Term Aggregate MOEs:

Intermediate- and long-term aggregate MOEs are calculated because the target MOE is 300 for both dermal and inhalation exposures. Therefore, aggregate MOEs ≥300 do not exceed HED's level of concern.

As shown on Table 13, with PPE and/or engineering controls only 4 exposure scenarios have MOEs ≥ 300 and therefore, do not exceed HED's level of concern for combined intermediate-term dermal and inhalation exposure. These scenarios are as follows:

- mixing/loading liquids for airblast application at 1 lb ai/A for 20 acres (total MOE=300);
- mixing/loading liquids for right-of-way sprayer at 0.5 lb ai/A for 40 acres (total MOE=300)
- flagging for spray applications at 0.5 and 1.25 lb ai/A for 350 acres (total MOE=330-820).

Aggregate Risk Index:

Once inhalation and dermal exposures are combined using the Aggregate Risk Index (ARI), regardless of duration, 10 exposure scenarios have ARIs greater than 1.0, and therefore do not exceed EPA's level of concern. All remaining exposure scenarios exceed EPA's level of concern, because the dermal risk estimates are less than 100. There are some potential long-term occupational exposures expected to occur for the registered uses of diazinon.

Table 13: Short- and Intermediate-term Risk Estimates for Occupational Handlers with PPE[1] and Engineering Controls (Target ARI ≥1 and target M0E ≥300)

Exposure Scenario	Application Rate by Rep. Crop or Method[2]	PPE		Engineering Controls	
		Total ARI (Short-term)	Total MOE (Intermediate-term)	Total ARI (Short-term)	Total MOE (Intermediate-term)
Mixer Loader Exposures					
(1a) M/L liquids for aerial application	Cole crops	0.13	19	0.22	34
	Corn	0.05 (350 acres) 0.02 (1200 acres)	7.4 (350 acres) 2.2 (1200 acres)	0.05 (350 acres) 0.02 (1200 acres)	0.05 (350 acres) 0.02 (1200 acres)
(1b) M/L liquids for chemigation	Cranberry	0.21	31	0.37	56
(1c) M/L liquids for groundboom application	Foliar rate	0.38 (80 acres) 0.15 (200 acres)	54 (80 acres) 22 (200 acres)	0.64 (80 acres) 0.26 (200 acres)	100 (80 acres) 40 (200 acres)
	Preplant rate	0.07 (80 acres) 0.03 (200 acres)	10 (80 acres) 4 (200 acres)	0.12 (80 acres) 0.05 (200 acres)	19 (80 acres) 7.4 (200 acres)
(1d) M/L liquids for airblast application	Hops/grapes	1.13 (20 acres)	160 (20 acres) 81 (40 acres)	1.93 (20 acres)	300 (20 acres)
		0.57 (40 acres)		0.96 (40 acres)	150 (40 acres)

Exposure Scenario	Application Rate by Rep. Crop or Method[2]	PPE		Engineering Controls	
		Total ARI (Short-term)	Total MOE (Intermediate-term)	Total ARI (Short-term)	Total MOE (Intermediate-term)
	Fruit trees	0.57 (20 acres) 0.28 (40 acres)	81 (20 acres) 40 (40 acres)	0.96 (20 acres) 0.48 (40 acres)	150 (20 acres) 74 (40 acres)
	Nut trees	0.38	54	0.64	100
(1e) Mixing/loading liquids for right-of-way sprayer	Right of way	1.13	160	1.9	300
(1f) M/L liquids for high pressure handwand (livestock areas)	Typical	0.57	81	0.96	150
	Maximum	0.28	40	0.48	74
(2a) M/L wettable powders for aerial application	Cole crops	0.01	1.3	0.08	13
	Corn	0.003 (350 acres) 0.001(1200 acres)	0.5 (350 acres) 0.16 (1200 acres)	0.003 (350 acres) 0.001(1200 acres)	0.003 (350 acres) 0.001 (1200 acres)
(2b) M/L wettable powders for chemigation	Cranberry	0.01	2.3	0.13	23
(2c) M/L wettable powders for groundboom application	Foliar rate	0.019	4	0.24	39
	Preplant rate	0.003 (80 acres) 0.001 (200 acres)	0.74 (80 acres) 0.3 (200 acres)	0.04 (80 acres) 0.02 (200 acres)	7 (80 acres) 3 (200 acres)
(2d) M/L wettable powders for airblast application	Hops/grapes	0.06 (20 acres) 0.03 (40 acres)	12 (20 acres) 6 (40 acres)	0.72 (20 acres) 0.36 (40 acres)	120 (20 acres) 60 (40 acres)
	Fruit trees	0.03 (20 acres) 0.01 (40 acres)	6 (20 acres) 3 (40 acres)	0.36 (20 acres) 0.18 (40 acres)	60 (20 acres) 29 (40 acres)
	Nut trees	0.02	4	0.24	39
(2e) M/L wettable powders for right-of-way sprayer	Right of way	0.06	12	0.72	120
(2f) M/L wettable powders for high pressure handwand (livestock areas)	Typical	0.03	5.9	0.36	58
	Maximum	0.01	3	0.18	29
(2g) Seed treatment	50 bushels corn	0.02	1.6	Not feasible	
(3) Loading granules for tractor-drawn broadcast spreaders	Preplant rate	0.1 (80 acres) 0.04 (200 acres)	22 (80 acres) 8.8 (200 acres)	0.53 (80 acres) 0.0.21 (200 acres)	150 (80 acres) 60 (200 acres)
Applicator Exposures					
(4a) Applying liquids with airblast sprayers	Hops/grapes	0.13 (20 acres) 0.06 (40 acres)	15 (20 acres) 7.4 (40 acres)	0.49 (20 acres) 0.25 (40 acres)	96 (20 acres) 48 (40 acres)
	Fruit trees	0.06 (20 acres) 0.03 (40 acres)	7.4 (20 acres) 3.7 (40 acres)	0.25 (20 acres) 0.12 (40 acres)	48 (20 acres) 24 (40 acres)
	Nut trees	0.04	4.9	0.16	32

Exposure Scenario	Application Rate by Rep. Crop or Method[2]	PPE		Engineering Controls	
		Total ARI (Short-term)	Total MOE (Intermediate-term)	Total ARI (Short-term)	Total MOE (Intermediate-term)
(4b) Applying liquids with groundboom sprayers	Foliar rate	0.63 (80 acres) 0.25 (200 acres)	91 (80 acres) 36 (200 acres)	1.2 (80 acres) 0.47 (200 acres)	180 (80 acres) 70 (200 acres)
	Preplant rate	0.12 (80 acres) 0.05 (200 acres)	17 (80 acres) 7 (200 acres)	0.22 (80 acres) 0.09 (200 acres)	33 (80 acres) 13 (200 acres)
(4c) Applying liquids with paint brushes	Typical	0.14	15	Not feasible	
	Maximum	0.07	7.6		
(4d) Applying liquids with airless sprayer	Typical	0.02	2.5	Not feasible	
	Maximum	0.01	1.3		
(4e) Applying liquids with high pressure handwand (livestock areas)	Typical	0.01	2.6	Not feasible	
	Maximum	0.01	1.3		
(4f) Rights-of-Way Sprayer	Rights of way	0.1	11	Not feasible	
(4g) Applying liquids with fixed-wing aircraft	Cole crops	No open cockpit data available		0.31	53
	Corn			0.12 (350 acres) 0.04 (1200 acres)	21 (350 acres) 6.1 (1200 acres)
(5) Applying granules with tractor-drawn broadcast spreaders	Preplant	0.12 (80 acres) 0.05 (200 acres)	25 (80 acres) 9.9 (200 acres)	0.08 (80 acres) 0.03 (200 acres)	21 (80 acres) 8 (200 acres)
Flagger Exposures					
(6) Flagging aerial (sprays)	Cole crops	0.28	35	3.9	820
	Corn	0.11 (350 acres) 0.03 (1200 acres)	14 (350 acres) 4 (1200 acres)	1.6 (350 acres)	330 (350 acres)
				0.45 (1200 acres)	95 (1200 acres)
Mixer/Loader/Applicator Exposures					
(7a) M/L/A liquids with low pressure handwand	Typical	0.61	90	Not feasible	
	Maximum	0.31	45		
(7b) M/L/A liquids with backpack sprayers	Livestock	0.22	26	Not feasible	
(7c) M/L/A liquids with high pressure handwand (greenhouse)	Typical	0.01	0.85	Not feasible	
	Maximum	0.003	0.42		
(7d) M/L/A liquids with handgun sprayer	Lawn care	0.22 (3 acres) 0.13 (5 acres)	23 (3 acres) 14 (5 acres)	Not feasible	
(8a) M/L/A wettable powders with low pressure handwand	Typical	0.02	4.2	Not feasible	
(8b) M/L/A liquids with low pressure handwand	Lawn care	0.05 (3 acres) 0.03 (5 acres)	9.5 (3 acres) 5.7 (5 acres)	Not feasible	
(9a) L/A granules with bellygrinder	Typical	0.03	3.2	Not feasible	
	Maximum	0.02	2.7		

Exposure Scenario	Application Rate by Rep. Crop or Method[2]	PPE		Engineering Controls	
		Total ARI (Short-term)	Total MOE (Intermediate-term)	Total ARI (Short-term)	Total MOE (Intermediate-term)
(9b) L/A granules with push-type spreader	Typical	0.2 (3 acres) 0.12 (5 acres)	24 (3 acres) 14 (5 acres)	Not feasible	
	Maximum	0.16 (3 acres) 0.1 (5 acres)	20 (3 acres) 12 (5 acres)		

[1] Risk estimates reflecting PPE include double layer clothing, chemical-resistant gloves, and ½ mask-respirator. All baseline exposures exceed EPA's level of concern regardless of exposure duration and therefore, were not included in the table.
[2] See Table 3 of the Occupational and Residential Exposure Assessment for specific application rates, assumed acreage and representative crops.

Postapplication Dermal Exposure:

Short- and intermediate-term postapplication dermal only exposures are expected as a result of the registered uses of diazinon on field crops. However, registered greenhouse uses are expected to result in both postapplication dermal and inhalation exposures, because it is an indoor use. EPA has concerns over short- and intermediate-term postapplication dermal exposures for workers reentering treated fields. MOEs for vegetable crops reach the target MOE at 2 to 6 days. MOE for tree fruit crops, grapes, berries, and field crops (e.g., beans, corn) reach the target MOE at 3 to 9 days. Tree nuts (walnuts) require a higher foliar application rate (3 lb ai/acre). The MOE does not reach the intermediate-term exposure MOE target until after 30 days. For workers reentering greenhouses, combined dermal and inhalation exposures are of concern at the current reentry interval of 12 hours. Based on chemical-specific data and information provided by the registrant for a 0.58 lb ai/acre rate of application, it is estimated that all dermal and inhalation exposures to workers re-entering greenhouses after treatment with diazinon type products exceed the Agency's level of concern until 8-10 days after application. All postapplication dermal and inhalation exposures from greenhouse activities result in risk estimates that exceed EPA's level of concern with the current REI.

Table 14: Days After Treatment" to Reach the Target MOE for Hand Harvesting [1]

Crop Grouping	Diazinon Specific Crops	Days After Treatment Target MOE Achieved		Pre-harvest Interval (days)
		Short-term	Intermediate-term	
Low berry	blackberries, raspberries, blueberries, cranberries, strawberries	4 - 5 (strawberry @ 1 lb ai/A = 3)	6 - 7 (strawberry @ 1 lb ai/A=4 to 5)	5 - 7
Bunch/Bundle	hops	3	5	14

Crop Grouping	Diazinon Specific Crops	Days After Treatment Target MOE Achieved		Pre-harvest Interval (days)
		Short-term	Intermediate-term	
Field row crop, low & medium	beans, peas	3	5	7
Field row crop, tall	sweet corn, sorghum	7	9	7
Field grown nursery ornamentals	carnation, chrysanthemum (No data available for some types of ornamentals such as azalea, boxwood, dogwood, juniper)	6 - 7	8	N/A (12 hr REI)
Deciduous tree fruit	apples, apricots, cherries, figs, nectarines, peaches, pears, plums	3 - 4 (7 to 8 for thinning)	8 (11 to12 for thinning)	21
Tree nuts	walnuts (almonds dormant spray only)	18	> 30	45
Root vegetables	beets, carrots, onions, parsnips, potatoes, radishes	2 - 3	4 -5	14+
Cucurbit vegetables	cucumbers, melons	3	5	7
Fruiting vegetables	peppers, tomatoes	2	3 - 4	1 - 5
Brassica vegetables	cole crops	3 - 4	5 - 6	7
Leafy vegetables	lettuce, parsley, spinach, swiss chard	2 - 3	4 - 5	10+
Vine & trellis crops	grapes	4 - 5 (6 for girdling, cane turning)	4 - 5 (7 - 8 for girdling, cane turning)	28

[1]Hand harvesting is considered a high-end exposure activity. Activities which result in longer REIs than hand harvesting have been noted in the table. MOEs for "lower" exposure activities such as weeding, irrigating or scouting have also been calculated; see Appendix B of the Occupational and Residential Exposure Chapter.

Ecological Risk Assessment

To estimate potential ecological risk EPA integrates the results of exposure and ecotoxicity using the quotient method. Risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic, for various wildlife species. RQs are then compared to levels of concern (LOCs). Generally, the higher the RQ, the greater the potential risk. Risk characterization provides further information on the likelihood of adverse effect occurring by considering the fate of the chemical in the environment, communities and species potentially at risk, their spatial and temporal distributions, and the nature of the effects observed in studies.

Historical Note

In January 1986, the EPA began the Special Review (the administrative process that can lead to cancellation) for golf course and sod farm uses of diazinon. The Special Review was initiated because of numerous bird kills associated with diazinon's use on golf courses and other turf sites. Laboratory toxicity studies and exposure data corroborated diazinon's high acute lethality. On March 29, 1988, diazinon use on golf courses and sod farms was canceled because of its high acute risk to birds. This decision was subsequently upheld in a Remand Decision of July 12, 1990, where it was determined that these uses "cause an unreasonable risk to birds commonly and with considerable frequency."

Nontarget Terrestrial Animal Risk

- Diazinon is very highly toxic to birds in most acute oral studies. It is also considered highly toxic to honey bees and other beneficial insects. Just one granule is enough to kill a small bird. Both acute lethal and reproductive effect levels for birds occur at residue levels well below those measured in the field. Field studies and incident reports support risk predicted by risk quotients. Acute RQ values for birds were as high as 4,725. Broadcast application of diazinon to turf generally poses the greatest risk to birds of any registered pesticide for use on turf. Large numbers of mortalities were also seen in studies on apples and corn. Mammals are less sensitive than birds orally, but diazinon is highly toxic dermally and very highly toxic based on inhalation exposure.

Nontarget Aquatic Animal Risk

- Diazinon is very highly toxic to freshwater fish and invertebrates following acute exposure. Toxicity estimates spanned 5 orders of magnitude. Based on estimated concentrations, RQ values ranged from 0.1 - 2.0 and 44 - 2,145, respectively. Chronic aquatic effect distribution spanned 3 orders of magnitude. Based on estimated concentrations, RQ values for fish and invertebrates ranged from 12 - 469 and 54 - 7,853 respectively. For estuarine/marine fish and aquatic invertebrates following acute exposure, toxicity estimates spanned 3 orders of magnitude with RQ values ranging from 0.07 - 2.6 and 2.1 - 102, respectively.

Endangered Species Risk

- The endangered species levels of concern are exceeded for wildlife, aquatic life and terrestrial plants in semi-aquatic areas for all registered uses rates of diazinon**.** Sublethal effects are of increasing concern in the Pacific Northwest and are relevant to endangered salmonids nationally. Recent literature indicates that at environmental concentrations, diazinon results in diminished olfactory response in Atlantic salmon.. Exposure to diazinon resulted in reduced responsiveness of male Atlantic salmon to female salmon pheromones. It has also been demonstrated that exposure to Chinook salmon to diazinon diminished responsiveness to predatory events and reduced homing response.

Incidents

- Diazinon is one of the leading causes of acute insecticide poisoning for humans and wildlife. For humans, the rate of incidents is not high relative to its large volume of usage with the majority of incidents occurring in the home. For ecological incidents reported involving organophosphates, diazinon accounted for the highest percentage (21%). From 1994 to 1998, diazinon had the highest number of reported bird kill incidents of any pesticide. It has the second highest number of bird kills reported over all years with only carbofuran having more incidents associated with pesticide use. Around 11% of diazinon related incidents involved aquatic species.

Public Comments

- Over 500 comments were submitted to the Agency in response to the Public Comment Period. Comments were submitted by registrants such as Novartis The Scotts Company and Y- Tex Corporation, private citizens, schools and universities, environmental groups such as NCAMP, NRDC, Environmental Defense Center, Rachel Carson Council, Inc. and the American Bird Conservancy, Federal departments such as U.S. Dept. of Interior and the U.S. Fish and Wildlife Service, state and local government councils, commodity/grower associations, as well as from water programs such as the Alameda Countywide Clean Water Program, the Cental Contra Costa Sanitary District and the California Stormwater Quality Task Force. The vast majority of comments were against the use of diazinon and were recommending for the cancellation of the pesticide.

Summary of Pending Data

The registrant will submit in December 2000, new dermal and inhalation data that are being finalized and is expected to be more representative of actual exposure durations. This could refine estimates for residential and occupational risks.

Summary of Data Used in Acute Dietary Exposure Assessment

Commodity	Sample composition	%CT[1] (max)	Summary of Data Source	Processing Factor
	B=blended; NB=not blended; PB= partially blended		commodity/source/yrs	DD=DEEM default PS=processing study
almond	PB	30	field trial data	na
apples	NB	10	apples/PDP/93-96	na
apples	PB	10	apples/PDP/93-96	DD=1
apples,dried	B	na	apples/PDP/93-96	DD=8
apples-juice	PB	33	apple juice/PDP/96-98	na
apricot	NB	79	peach-fresh/PDP/94-96	na
apricot	PB	68	peach-can/PDP/97	DD=1
apricot, dried	B	na	peach-fresh/PDP/97	DD=6
banana	NB/PB/B	100	banana/PDP/94-95	DD =3.9 (dried)
beef-fat, veal-fat	na	14	cattle ear tag studies	na
beets-garden-roots	NB/PB	53	beets-garden-roots/FDA/92-97	na
beets-garden-tops	PB	53	spinach-fresh/PDP/95-97	na
black berry/black berry juice	PB	23	black berry + raspberry/FDA/92-98	DD=1
blueberries	PB	11	blueberries/FDA/92-98	na
bok choy	PB	100	bok choy/FDA/92-98	na
broccoli	NB/PB	21	broccoli/PDP/94	na
Brussels sprouts	PB	100	broccoli/PDP/94	na
cabbage	NB	17	cabbage/FDA/92-98	na
cabbage	PB	31	cabbage/FDA/92-98	DD=1
cabbage-savoy	NB	17	cabbage/FDA/92-98	na
cantaloupe	NB/PB	18	cantaloupe/FDA/92-98	na
carrots	NB	20	carrots/PDP/94-96	na
carrots	PB	20	carrots/PDP/94-96	DD=1
cauliflower	NB/PB	31	cauliflower/FDA/92-98	na
celery	NB	15	celery/PDP/93-94	na
celery	PB	15	celery/PDP/93-94	DD=1
cherries	PB	29	cherries/FDA/92-98	na(fresh) DD=4(dried) DD=1.5(juice)
coffee	B	100	tolerance for coffee bean	DD=1
collard	PB	28	collards+kale+mustard green/FDA	na
cottonseed	B	1	tolerance for cottonseed	PS=.44(meal) PS=2.2(oil)
cranberries	PB	73	field trial data	DD=1.1(juice)
cucumber	NB	7	cucumbers/FDA/92-98	na
cucumber	PB (proc)	12	cucumbers/FDA/92-98	DD=1
dandelion-green	PB	100	spinach/PDP/95-97	na
endives-escarole	PB	100	endives-escarole/FDA/92-98	na
figs	NB	26	field trial data	na
filberts	PB	12	field trial data	na
garlic	NB/PB	11	dry-bulb onions/FDA/92-98	na
ginseng	PB	100	carrots/PDP/94-96	na
grape juice	PB	7	grape-juice/PDP/98	na
grapefruit	NB	4	oranges/PDP/94-96	na
grapefruit juice	PB	40	orange juice/PDP/97-98	na
grapefruit peel	PB	4	citrus tolerance (0.7 ppm)	na

Commodity	Sample composition	%CT[1] (max)	Summary of Data Source	Processing Factor
	B=blended; NB=not blended; PB= partially blended		commodity/source/yrs	DD=DEEM default PS=processing study
grapes	PB	52	grapes/PDP/94-96	na (fresh) PS=.13 (raisin)
green beans-canned	PB	8	green beans-canned/PDP/96-98	na
green beans-fresh	PB	3	green beans-fresh/PDP/94-95	na
green beans-frozen	PB	8	green beans-frozen/PDP/96-98	na
honeydew	NB/PB	10	cantaloupe/FDA/92-98	na
hops	B	---	field trial data	na
kale	PB	1	collards+kale+mustard green/FDA	na
kiwi fruit	NB/PB	100	kiwi fruit/FDA/92-98	na
kohlrabi	NB	100	cauliflower/FDA/92-98	na
lemon/lime peel	PB	1	citrus tolerance (0.7 ppm)	na
lettuce-head	NB	39	lettuce/PDP/94	na
lettuce-leafy	PB	68	lettuce/PDP/94	na
lettuce-unspecified	PB	52	lettuce/PDP/94	na
mushrooms	PB	100	field trial data	na
mustard green	PB	39	collards+kale+mustard green/FDA	na
nectarines	NB	100	peach-fresh/PDP/94-96	na
onions-dry	B	na	dry-bulb onions/FDA/92-98	DD=9
onions-dry	NB/PB	16	dry-bulb onions/FDA/92-98	DD=9
onions-green	NB/PB	23	green onions/FDA/92-98	na
orange-juice	PB	40	orange-juice/PDP/97-98	na
oranges	NB/PB	3	oranges/PDP/94-96	na
orange peel	PB	3	citrus tolerance (0.7 ppm)	na
other cane berries[2]	PB	45	blackberry + raspberry/FDA/92-98	na
other citrus[3]	NB/PB	1	orange/PDP/94-96	na
parsley	PB	8	spinach/PDP/95-97	na
parsnips	NB	100	carrots/PDP/94-96	na
peach	NB	47	peach-fresh/PDP/94-96	na
peach	PB	20	peach-can/PDP/97	na
peach-dried	B	na	peach-fresh/PDP/94-96	DD=7
pear	NB	24	pear, single-serving/PDP/7-98--6-99	na
pear	PB	31	pear/PDP/96-98	DD=1
pear	B	na	pear/PDP/96-98	DD=6.25(dried)
pepper-chilli, jalapeno	NB	1	green pepper/FDA/92-98	na
pepper-chilli, jalapeno	PB	1	green pepper/FDA/92-98	na
pepper-green	NB	19	green pepper/FDA/92-98	na
pepper-green	PB	19	green pepper/FDA/92-98	na
pineapples	NB/PB	100	field trial data	na
pineapples	B	na	---	DD=5(dried)
plums	NB	54	plums/FDA/92-98	na (fresh) DD=3.9(prune) DD=1.4(juice)
potato	NB/PB	1	potatoes/PDP/94-95	na
potato	B	1	potatoes/PDP/94-95	DD=6.5(dried)
radicchio	NB	100	lettuce/PDP/94	na
radishes-oriental	NB	100	radish-oriental/FDA/92-98	na
radishes-roots	PB	7	radish-root/FDA/92-98	na
raspberry	PB	45	raspberry/FDA/92-98	na

Commodity	Sample composition	%CT[1] (max)	Summary of Data Source	Processing Factor
	B=blended; NB=not blended; PB= partially blended		commodity/source/yrs	DD=DEEM default PS=processing study
rutabagas	NB	100	carrots/PDP/94-96	na
sheep-fat	na	37	dermal treatment studies	na
sheep-kidney	na	37	dermal treatment studies	na
sheep-lean	na	37	dermal treatment studies	na
sheep-liver	na	37	dermal treatment studies	na
sheep-meat byproducts	na	37	dermal treatment studies	na
sheep-other organ meats	na	37	dermal treatment studies	na
sorghum	B	1	wheat/PDP/95-97	na
spinach-can	PB	60	spinach-can/PDP/97-98	na
spinach-fresh	PB	44	spinach-fresh/PDP/95-97	na
squash-summer	NB	9	summer squash/FDA/92-98	na
squash-summer	PB	9	summer squash/FDA/92-98	DD=1
squash-winter	NB	42	winter squash/PDP/97-98	na
strawberries	PB	16	strawberries/PDP/98	na
sugar beets	B	na	beets-garden-roots/FDA/92-97	na
sugar beets molasses	B	6	beets-garden-roots/FDA/92-97	PS=0.5
sweet corn	NB/PB	13	sweet corn/FDA/92-98	na
sweet corn-canned	PB	13	sweet corn-can/PDP/94-96	na
sweet corn-frozen	PB	13	sweet corn-frozen/PDP/94-96	na
sweet peas-canned	PB	8	sweet peas-fresh/FDA/94-96	DD=1
sweet peas-fresh	PB	8	sweet peas-fresh/FDA/92-98	na
sweet peas-frozen	PB	8	sweet peas-frozen/PDP/94-96	na
sweet potato	NB/PB	13	sweet potato/PDP/96-98	na
Swiss chard	NB	100	celery/PDP/93-94	na
tomato	NB	38	tomato/PDP/96-98	na
tomato	PB	38	tomato/PDP/96-98	na
tomato	B (not proc)	na	tomato/PDP/96-98	na
tomato	PB (proc)	21	tomato/PDP/96-98	PS=.3(catsup) DD=14.3(dried) PS=.5(juice) PS=.6(paste) PS=.7(puree)
turnip-roots	NB	100	carrots/PDP/94-96	na
turnip-tops	PB	100	spinach-fresh/PDP/95-97	na
walnuts	PB	14	field trial data	na
watercress	PB	100	field trial data	na
watermelon	NB/PB	5	watermelon/FDA/92-98	na